

CNAP Annual Report, 2013-2014

1. **Award Title** (must match the name on your award):

California-Nevada Climate Applications Program (CNAP)

2. **Performance Period** (from previous progress report through May 30, 2014):

April 1, 2013 - May 30, 2014

3. **Who are your team members?** Please include graduate students and post-doctoral researchers in this list.

Daniel Cayan, Michael Dettinger, Kelly Redmond, Anne Steinemann, Tim Brown, Alexander Gershunov, Randall Hanson, Sam Iacobellis, Nina Oakley, David Pierce, Mary Tyree, Tamara Wall, LeRoy Westerling.

4. **Please list any new areas of research focus or new partnerships** that have begun this past year, along with some context for why you are expanding into this area or partnership.

ARkStorm@Tahoe is a source of several new partnerships in the Tahoe/Reno/Carson City area, including the University of Nevada (UNv) Reno Academy for the Environment, Tahoe Science Consortium, Tahoe Environmental Research Center, Truckee River Flood Project, Regional Emergency Operations Center, California-Nevada River Forecast Center. This extension of the past ARkStorm emergency-preparedness projects allowed us to interact with a very “climate-interested” community about needs and challenges in using hydroclimatic info of various sorts, and allowed us to explore real-world flood and storm risks in contexts of snowy, high-altitude, and environmentally sensitive and protected settings. Currently these new connections are being expanded to: (a) serve on the Tahoe Committee of Scientists, (b) participate in a new NSF-funded Water Sustainability and Climate project (with UNR and others) regarding hydroclimatic and social conditions/adaptations to drought across northwest Nevada, and (c) going in with UNv Cooperative Extension on a proposal to USDA to address climate-centered issues for agriculture/ranching communities on tribal lands throughout the Great Basin.

We began research in usability of web pages that provide weather/climate data with Southwest CSC/WRCC. This research is an effort to make weather and climate data and information easier to access for data users in a variety of fields such as resource management, ecology, engineering, as well as the atmospheric sciences. While fielding data requests for the WRCC, we found that many people struggled to find the data they needed or did not understand the flow of making a data request, and felt we could improve our climate services by researching how people search for climate data.

We began working with the Washoe County Emergency Manager and other city and county employees to develop a climate resiliency plan for Washoe County. We expect the plan to be released in June 2014, and it will also provide input for the county's FEMA 5-year multi hazard plan. We expect this to be a foundational plan, and the relationships developed will be integral to further climate information use and outreach in Nevada.

The DRI Climate, Ecosystem and Fire Application (CEFA) partnership with the USDA Forest Service Research, Development and Applications program has expanded to include a project on Extreme Wildfire and Prescribed Fire Behavior. This project focuses on a better understanding of the factors involved in wild land firefighter's surprise at unexpected or unpredicted fire behavior, particularly as it may relate to extreme climate and weather related events.

We partnered with USFS Region 5 (Pacific Southwest) Regional Office to provide products depicting the influence of fuels treatments and climate change on wildfire to feed into the Sierra Nevada Forest Plan revision currently underway. We will use models and methodology already developed with support from NOAA and the California Energy Commission to describe how different scenarios will affect extreme wildfire events in the Sierra Nevada. We signed a five-year research contract to serve as an umbrella for this collaboration, and \$75,000 was supplied on an accelerated basis to fund the first half-year. USFS developed and provided their own scenarios for fuels treatments as GIS layers, and we are incorporating these into our wildfire size distribution models.

We have expanded our studies of coastal climate variation, including studies of the variability of low clouds along the West Coast and North Pacific wave variability.

We have extended our studies of hydroclimate variability over the Southwest U.S., with emphasis on drought and heavy precipitation.

5. **Please provide a list of up to 5 research findings.** Please try to include examples that span disciplinary and interdisciplinary work. Examples might be: a) dust-on-snow reduces Colorado River runoff by 5%, or b) analysis revealing the presence or absence of adaptive capacity in legal and policy frameworks for managing resources.

A recent study published in Geophysical Research Letters by Schwartz et al. 2014 describes a broad scale decadal mode of Coastal Low Cloud variation over the coastal land margin of western North America from San Diego to Adak. Thus, the variation in marine layer low clouds has a mode that is coherent from Alaska to Southern California. This mode is associated with PDO-like low frequency variability of Pacific sea surface temperatures.

A study published in Nature Scientific Reports by Polade et al. (2014) analyzes a set of CMIP5 global climate model projections and describes how future changes in the number of dry days per year can either reinforce or counteract projected increases in daily precipitation intensity as the climate warms. Changes in the number of dry days and the precipitation intensity on precipitating days combine to produce changes in annual precipitation--over much of the subtropics the change in number of dry days dominates the annual changes in precipitation and accounts for a large part of the change in interannual precipitation variability. Related to these findings, climate models clearly project less frequent precipitation, but stronger extreme events in CA/NV, leading to more interannual variability, but they do not agree on the sign of projected changes in total annual precipitation in the Southwest.

Flaws in existing downscaling schemes cause too much spatial coherence in precipitation fields, which can exaggerate the likelihood of regional flooding in climate projections. We have developed an improved "Localized Constructed Analogues" (LOCA) downscaling scheme that fixes this problem. Existing bias-correction schemes applied to regional climate projections typically alter the original model-predicted trend, despite having no good physical rationale for doing so. We have developed an improved bias corrected scheme that fixes this problem.

Historical multi-year droughts in California have been almost entirely reflections of deficits in the occurrence of the largest storms (95th percentile and above of wet days, i.e., those wettest storms occurring only 5-7 days/yr on average). Annual contributions to total precipitation from these largest storms explain >90% of variance in annual precipitation and contributions from all the smaller storms only capture ~25% of variance. Thus extreme storms and drought are two sides of same coin in California.

ARkStorm@Tahoe demonstrated that the communities in the Tahoe/Reno/Carson City area are extremely eager to receive and explore new hydroclimatic information, especially (in case of this project) as applies to weather extremes and emergencies. The Tahoe/Reno/Carson City

communities/agencies were much more eager to address these issues than any comparable populations we have found in California “proper.”

Drought severity in California, based on a 12-month precipitation anomaly, was below 0.01% across much of the state. The likelihood of drought recovery to normal or above-normal conditions by October 1, 2014, based on a 24-month precipitation anomaly, in the Sacramento River Basin, is less than 7%.

Verb form strongly influences perceptions of climate risk: active tense, continuing action verbs cause study subjects to put a significantly higher assessment on the level of risk, even when all information content is the same.

Substantial future increases in wildfire-caused air pollution emissions are projected across a wide range of future climate and growth scenarios. The increase for the California-Nevada region is concentrated in relatively small areas of northern California forests, and the populations directly impacted are likely concentrated in a small number of rapidly growing areas of California and Nevada.

6. **Please provide a list of up to 5 outreach activities** that you have undertaken in the past year. OPTIONAL: If applicable, please share the outcomes of these activities.

We have demonstrated our new bias correction and downscaling techniques for a US Bureau of Reclamation audience on a webinar. Outcome: The USBR and Army Core of Engineers were interested enough to fund application of the new downscaling technique to model projections for the continental U.S.

We have participated in a climate and disease ecology workshop as a representative of the physical climatology field, illustrating data and methods that can be applied to research on the future of dengue fever, malaria, and chikungunya. A white paper is in progress describing possible changes in the geographical ranges of these diseases, with possible future research collaborations on the horizon.

Dettinger has been a key organizer of ARkStorm@Tahoe, which has involved 7 major workshops (up to 150 people at each) to address the potential severe-storm implications and responses for public utilities, emergency responders, businesses, government agencies, flood management, tribes, and natural resource managers. A report documenting those workshops and findings/actions therefrom is (as noted) in the works, including results from participant surveys.

We have provided lesson in climate for Tahoe Environmental Research Center's afterschool science program for gifted CA and NV high school students. Outcome: students understand how climate is monitored by surface stations and understand how scientists use ice cores to determine characteristics of historic climates. Presentation for 6th graders at Veteran's Memorial Elementary, a Title 1 school in Reno, NV. Outcome: students understand difference between weather and climate, how climate is monitored by surface stations, and understand how scientists use ice cores to determine characteristics of historic climates. Presentation for 3rd graders at C.C. Meneley Elementary in Gardnerville. Outcome: students understand difference between weather and climate, how climate is monitored by surface stations, and how anemometers are used to measure wind.

We have had several engagements with decision makers to explain, provide information, and understand their responses to the ongoing California drought. The California Drought Forums on February 20, 2014, and May 15-16, 2014, in conjunction with NIDIS, brought together over 250 attendees in person, and more than 150 by webinar, representing a range of government agencies, industries, small to large water agencies, agriculture, non-governmental organizations, scientists, tribes, and other stakeholders from across the state. Results from surveys, conducted at the Forum, testify to the value of the drought research and resources provided by RISA and NIDIS. For instance, 93% of the participants said that the presentations on drought conditions and forecasts (featuring work from CNAP) were useful to them. We discussed origins and structure of the California Drought in presentations at the

University of California Drought Summit, and the Climate Change Science seminar for Policymakers.

Great Basin Climate Forums, in collaboration with the Great Basin LCC. The fall Great Basin Climate Forum was held in October 2013 in Bishop, CA, and was well attended by about 35 natural resource managers from tribal, federal, state, and county agencies and organizations, as well as interested community members. The spring 2014 forum was held in Reno, NV in April with about 75 people attending. The forum continues to draw an increasingly diverse audience, from federal, state, tribal, NGOs, and local agencies and organizations. This year also included representatives from the air quality sector, from both state and county agencies. In its third year, the Great Basin Climate forum is becoming known as an outstanding source of current climate information and relevant climate-related topics drawing individuals from across many sectors relevant to the National Climate Assessment and NOAA.

Tribal Climate Change Adaptation Workshop (in collaboration with the Institute for Tribal Environmental Professionals (ITEP) and the Great Basin LCC). Funded primarily by the EPA, this workshop series focuses on providing tribal members a framework for beginning to develop climate change adaptation plans for their communities. A major outcome of this workshop is the funding of 2-3 additional workshops in Great Basin Region funded by the Great Basin LCC/BLM. (and possibly California with the support of the California LCC). CNAP will provide additional logistical support to ITEP, as well as reprise their role as instructor/facilitators during the workshop.

Westerling visited the California state legislature and met with staffers and members in several offices and committees in April 2013, and participated in a forum on climate change, wildfire and insurance in Pasadena, CA in June 2013: Insurance in the Era of Climate Change. This event was sponsored by UCS and California State Senator Liu. Upon request by California Governor Jerry Brown's office, Westerling drafted an Op-Ed discussing recent changes in wildfire regimes in California and the Western US that are consistent with climate change, in response to a series of distorted articles in prominent news outlets by climate deniers claiming that fire activity and drought frequency have decreased and will continue to decrease due to climate change.

We explored the current development and some possible California impacts of El Nino 2014 - Possible Impacts and Preparedness Discussion Scripps Institution of Oceanography.

7. **Please provide a list of key publications from the past year** - We are seeking ~ 5 publications, give or take a few, to be highlighted on the CPO webpage. These can be either non-peer reviewed or peer-reviewed. For peer-reviewed publications, please list either published or in press, but not "in review." For non peer-reviewed publications, please provide a hyperlink or webpage wherever possible. (You may include a more comprehensive list of publications as an appendix.) *** **please see full list of publications at end of document** ***

Dettinger, M.D., 2013, Atmospheric rivers as drought busters on the US west coast: Journal of Hydrometeorology, 14, 1721-1732, doi:10.1175/JHM-D-13-02.1.

Guirguis, K., A. Gershunov, A. Tardy and R. Basu, 2014: The Impact of Recent Heat Waves on Human Health in California. Journal of Applied Meteorology and Climatology, 53, 3-19.

Iacobellis, S.F, and D.R. Cayan, 2013: The variability of California summertime marine stratus: Impacts on surface air temperatures. Journal of Geophysical Research-Atmospheres, 118, 9105-9122. doi:10.1002/jgrd.50652

Oakley, N. S., and K. T. Redmond (In Press): A Climatology of 500 hPa Closed Lows in the Northeast Pacific, 1948-2011. J. Appl. Meteor. Climatol.

Polade, S.D., Pierce, D.W., Cayan, D.R., Gershunov, A. & Dettinger, M.D. 2014: The key role of dry days in changing regional climate and precipitation regimes. Nature Scientific Reports 4, 4364; DOI:10.1038/srep04364.

Rodó X, Curcoll R, Robinson M, Ballester J, Burns JC, Cayan DR, Lipkin WI, Williams BL, Couto-Rodriguez M, Nakamura Y, Uehara R, Tanimoto H, Morguá J.A., 2014. Tropospheric winds from northeastern China carry the etiologic agent of Kawasaki disease from its source to Japan. Proceedings of the National Academy of Sciences, in press, <http://dx.doi.org/pnas.org/cgi/doi/10.1073/pnas.1400380111>

Steinemann, A. "Drought Information for Improving Preparedness," Bulletin of the American Meteorological Society (in press)

Schwartz, R.E., A. Gershunov, S.F. Iacobellis, and D.R. Cayan, 2014: North American west coast summer low cloudiness: Broad-scale variability associated with sea surface temperature. Geophysical Research Letters, IN PRESS. doi:10.1002/2014gl059825.

White, A.B., Anderson, M.L., Dettinger, M.D., Ralph, F.M., Hinajosa, A., Cayan, D.R., Hartman, R.K., Reynolds D.W., Johnson, L.E., Schneider, T.L., Cifelli, R., Toth, Z., Gutman, S.I., King, C.W., Gerhke, F., Johnston, P.E., Walls, C., Gottas, D.J., and Coleman, T., 2013, A 21st Century California observing network for monitoring extreme weather events: Journal of Atmospheric and Oceanic Technology, 30, 1585-1603, doi:10.1175/JTECH-D-12-00217.1.

8. **Please provide up to 3 narrative examples** from the past year of plans, policies, strategies, tools, agreements, etc. that were proposed, adopted, and/or implemented as a result of RISA work.

Dan Cayan and Sam Iacobellis, in participating in the Santa Barbara Area Coastal Ecosystem Vulnerability Assessment (SBA CEVA), are contributing climate data, and downscaled climate projections for the Santa Barbara area. They will evaluate historical climate patterns and possible climate changes, including temperature, precipitation, and sea level rise.

David Pierce and Dan Cayan have developed a new Localized Constructed Analogues (LOCA) statistical downscaling technique, along with frequency dependent bias correction. In response to needs by the multiple agencies of the State of California and by the US Bureau of Reclamation, the US Army Corps of Engineers, the U.S. Geological Survey and others for downscaled GCM projections, a plan has been implemented to produce a set of LOCA downscaled CMIP5 climate simulations. Primary support for this activity is being provided by the California Energy Commission, the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation; the CNAP RISA has provided underpinning support over multiple years. Computer resources are being provided by NASA AMES research partners.

ARkStorm@Tahoe discussions, simulations and responses are to form the underpinnings of a Flood Awareness Week program being put together by UNR's Cooperative Extension program this fall and for parts of this fall's Tahoe Science Symposium. I have been told (by USBR colleague) but cannot absolutely verify that the USBR is using ARkStorm as a basis (justification?) for a dam-break exercise at Friant Dam above Fresno in the coming year.

The support of CNAP was integral to the development of the Washoe County Climate Resiliency Plan. Without the support of CNAP PIs and researchers, the resiliency plan would likely not have been completed and released to county leaders and the public. One of the first such plans in Nevada, CNAPs role in successfully supporting the development of this plan will help enable us to develop similar plans across Nevada.

The Fire Danger PocketCard (implemented in 1997) provides a format for interpreting and communicating key fire danger index values provided from the National Fire Danger Rating System. The PocketCard objective is to lead to greater awareness of fire danger and increase firefighter safety. Project work with the USDA Forest Service provided 21 recommendations for updates and changes to the PocketCard to improve information presentation and training.

A collaboration between the USFS Predictive Services, San Diego Gas and Electric, DRI, UCLA, the National Weather Service, and Scripps Institute of Oceanography, the project is developing an index that forecasts large fire growth potential for Southern California. My part in the project has been to develop an understanding of fire managers concerns, public information sources for weather and wildfire information, and perceptions of risk. Two

surveys were done, one in 2012 and a follow up survey in 2013 that looked at wildfire risk mitigation actions in homeowners in Southern California. Once the project is deployed in the fall of 2014, a post-evaluation assessment is planned. This project has been an excellent collaboration between public, private, and federal agencies to reduce wildfire risk in a highly populated wildland urban interface region and provide significant decision support for staging and deploying resources as well as informing the general public of large fire growth potential and wildfire risk.

CNAP and NIDIS-sponsored research to analyze the California drought has been used by water officials, decision-makers, and stakeholders across the state to assess the severity of the current drought, place the current drought in historical context, inform decisions to reduce drought impacts, and communicate drought conditions in ways that are meaningful and intuitive to the public. CNAP drought research has been presented to over 500 stakeholders, and to the Governor-appointed California Water Commission and the Western States Water Council. Members of the Commission, and participants at the meetings, said that the drought indicator system was (to summarize quotes): "really useful - it shows drought in ways that make sense; a great way to portray drought - gives decision-makers what they need; an approach we'd like to adopt for our system; and something we'd like to use throughout the state."

Our work on wildfire scenarios is feeding directly into development of the Forest Plan revision for the Sierra Nevada, as described above. This plan is the first attempt to directly incorporate climate change into forest management plans by the Forest Service, and will serve as a template for similar processes to be launched in other Forest Service regions around the western US.

9. **OPTIONAL: How do you measure success?** Please provide information on 1-3 metrics or indicators that you use to evaluate your projects and/or program. These will be compiled into a RISA-wide resource to enable sharing among RISAs.

Use and value of CNAP information and resources

- number of stakeholders using CNAP information
- type of information used
- frequency of use
- scope of influence
- decisions or policies influenced by CNAP information
- integration of CNAP information into decision-making, plans, and activities
- monetary and non-monetary benefits

CNAP scientist-stakeholder Interactions

- number of partnerships
- diversity of stakeholders
- number of projects
- longevity of partnerships
- number of new partnerships each year

CNAP journal articles and publications

CNAP reports given to and used by decision-makers

Media and other outside interest and coverage

Invitations to participate in various advisory groups and meetings

Eagerness and energy of stakeholder participation

For web-based projects and resources:

- number of users / hits
- number of users we hear from when something is not functioning on the pages

For school visits:

- letters from kids, content that reflects the intended goals of visit

10. Please fill out the Project Database for projects that meet all of the following criteria

(NOTE: These criteria are generally a judgment call on the part of the Principal Investigator(s) and/or the Program Managers and do not require extensive analysis. Criteria should **not** be listed in database.):

- Core RISA projects – Determined by one or more of the following:
 - i. RISA investigator is leading the effort
 - ii. RISA is primary source of funding
 - iii. RISA capacity is critical to the project (e.g. Regional Chapters/Technical Inputs of the NCA)
- Current projects – Determined by one or more of the following:
 - i. Recently completed (i.e. finished within the last six months)
 - ii. Ongoing (i.e. initiated, but not completed)
 - iii. Planned (i.e. funded but not started)

*** please see separate attachment ***

PUBLICATIONS

Peer-Reviewed Journal Articles:

Ballester J, Burns JC, Cayan D, Nakamura Y, Uehara R, Rodó X. Kawasaki disease and ENSO-driven wind circulation. *Geophysical Research Letters* 40, 2284–2289 (2013).

Bromirski, P.D., D.R. Cayan, J. Helly and P. Wittmann, 2013: Wave power variability and trends across the North Pacific. *Journal of Geophysical Research Oceans*, 118, doi:10.1002/2013JC009189.

Brown, L.R., Bennett, W.A., Wagner, W., Morgan, T., Knowles, N., Feyrer, F., Schoellhamer, D., Stacey, M., and Dettinger, M.D., 2013, Implications for future survival of deltas smelt from four climate-change scenarios for the Sacramento-San Joaquin Delta, California: *Estuaries and Coasts*, 21 p., doi:10.1007/s12237-013-9585-4.

Das, T., E.P. Maurer, D.W. Pierce, M.D. Dettinger and D.R. Cayan, 2013: Increases in flood magnitudes in California under warming climates. *Journal of Hydrology*, 501, 101-110.

Dettinger, M.D., 2013, Atmospheric rivers as drought busters on the US west coast: *Journal of Hydrometeorology*, 14, 1721-1732, doi:10.1175/JHM-D-13-02.1.

Gershunov, A., Rajagopalan, B., Overpeck, J., Guirguis, K., Cayan, D., Hughes, M., Dettinger, M., Castro, C., Schwartz, R., Anderson, M., Ray, A., Barsugli, J., Cavazos, T., and Alexander, M., 2013, Future climate—Projected extremes: Chapter 7 in Garfin, G., Jardine, A., Merideth, R., Black, M., and Leroy, S. (eds.), *Assessment of Climate Change in the Southwest United States*, Island Press, 126-147.

Guirguis, K., A. Gershunov, A. Tardy and R. Basu, 2014: The Impact of Recent Heat Waves on Human Health in California. *Journal of Applied Meteorology and Climatology*, 53, 3-19.

Hoerling, M., Dettinger, M., Wolter, K., Lukas, J., Eischeid, J., Nemani, R., Liebmann, B., and Kunkel, K., 2013, Present and climate--Evolving conditions: Chapter 5 in Garfin, G., Jardine, A., Merideth, R., Black, M., and LeRoy, S. (eds.), *Assessment of Climate Change in the Southwest United States*: Island Press, 74-100.

Hurteau, M.D., A.L. Westerling, C. Wiedinmyer, B.P Bryant: "Projected Effects of Climate and Development On California Wildfire Emissions through 2100," *Journal of Environmental Science and Technology*, 2014, 48 2298-2304.

Maurer, E.P., Brekke, L., Pruitt, T., Thrasher, B., Long, J., Duffy, P., Dettinger, M., Cayan, D., and Arnold, J., 2014: An enhanced archive facilitating climate impact analysis: Bulletin of American Meteorological Society, in press

Neiman, P.J., Ralph, F.M., Moore, B.J., Hughes, M., Mahoney, K.M., and Dettinger, M.D., 2013, The landfall and inland penetration of a flood-producing atmospheric river in Arizona—Part I, Observed synoptic-scale and hydrometeorological characteristics: Journal of Hydrometeorology, 14(2), 460-484, doi:10.1175/JHM-DS-12-0101.1.

Overpeck, J., Garfin, G., Jardine, A., Busch, D., Cayan, D., Dettinger, M., Fleishman, E., Gershunov, A., MacDonald, G., Redmond, K., Travis, W., and Udall, B.H., 2013, Assessment of climate change in the southwest United States—Summary for decisionmakers: Chapter 1 in Garfin, G., Jardine, A., Merideth, R., Black, M., and Leroy, S. (eds.), Assessment of Climate Change in the Southwest United States, Island Press, 20 p. [Also published as Garfin, G., Jardine, A., Merideth, R., Black, M., and LeRoy, S., eds., 2014, Resumen para tomadores de decisiones--Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment. Southwest Climate Alliance. Washington, DC: Island Press.]

Pierce, D. W., A. L. Westerling, and J. Oyler, 2013: Future humidity trends over the western United States in the CMIP5 global climate models and variable infiltration capacity hydrological modeling system. Hydrol. Earth Syst. Sci., v. 17, 1833-50.

Pierce, D. W., D. R. Cayan, T. Das, E. P. Maurer, N. L. Miller, Y. Bao, M. Kanamitsu, K. Yoshimura, M. A. Snyder, L. C. Sloan, G. Franco, and M. Tyree, 2013: The key role of heavy precipitation events in climate model disagreements of future annual precipitation changes in California. J. Climate., v. 26, 5879-5896.

Polade, Suraj D., A. Gershunov, D. R. Cayan, M. D. Dettinger, and D. W. Pierce, 2013: Natural climate variability and teleconnections to precipitation over the Pacific-North American region in CMIP3 and CMIP5 models. Geophysical Research Letters, doi:10.1002/grl.50491.

Polade, S.D., Pierce, D.W., Cayan, D.R., Gershunov, A. & Dettinger, M.D. 2014: The key role of dry days in changing regional climate and precipitation regimes. Nature Scientific Reports 4, 4364; DOI:10.1038/srep04364.

Prahn, N., B. Longo, K. Baxter, and T.J. Brown, 2013: Lightning Does Strike Twice: A Fulminology Primer for Nurse Practitioners. J. Nurse Practitioners, 9, 479-486.

Ralph, F.M., Coleman, T., Neiman, P.J., Zamora, R., and Dettinger, M., 2013, Observed impacts of duration and seasonality of atmospheric river landfalls on soil moisture and runoff: Journal of Hydrometeorology, 14(2), 443-459, DOI:10.1175/JHM-D-12-0.76.1.

Ralph, F.M., Dettinger, M.D., White, A., Reynolds, D., Cayan, D., Schneider, T., Cifelli, R., Redmond, K., Anderson, M., Gehrke, F., Jones, J., Mahoney, K., Johnson, L., Gutman, S., Chandrasekar, V., Lundquist, J., Molotch, N., Brekke, L., Pulwarty, R., Horel, J., Schick, L., Edman, A., Mote, P., Abatzoglou, J., Pierce, R., Wick, G., 2014, A vision of future observations for western US extreme precipitation and flooding: *Journal of Contemporary Water Resources Research and Education*, 153, 16-32.

Rick, T. T. Scott Sillett, Cameron K. Ghalambor, Courtney A. Hofman, Katherine Ralls , R. Scott Anderson , Christina L. Boser , Todd J. Braje , Daniel R. Cayan, et al. 2014: From the Pleistocene to the Anthropocene: 20,000-Years of Ecological-Change and the Future of Biodiversity on California's Channel Islands" in press *BioScience*.

Rodó X, Curcoll R, Robinson M, Ballester J, Burns JC, Cayan DR, Lipkin WI, Williams BL, Couto-Rodriguez M, Nakamura Y, Uehara R, Tanimoto H, Morguá J.A., 2014. Tropospheric winds from northeastern China carry the etiologic agent of Kawasaki disease from its source to Japan. *Proceedings of the National Academy of Sciences*, in press, <http://dx.doi.org/pnas.org/cgi/doi/10.1073/pnas.1400380111>

Rosenberg, E.A., Wood, A.W., Steinemann, A.C., "Informing hydrometric network design for statistical seasonal streamflow forecasts." *Journal of Hydrometeorology* 14(5):1587-1604, 2013.

Schwartz, R.E., A. Gershunov, S.F. Iacobellis and D.R. Cayan, 2014: North American West Coast Summer Low Cloudiness: Broad Scale Variability Associated with Sea Surface Temperature. *Geophysical Research Letters*. In press.

Steinemann, A. "Drought Information for Improving Preparedness," *Bulletin of the American Meteorological Society* (in press)

Vano et al Julie A. Vano, Bradley Udall, Daniel R. Cayan, Jonathan T. Overpeck, Levi D. Brekke, Tapash Das, Holly C. Hartmann, Hugo G. Hidalgo, Martin Hoerling, Gregory J. McCabe, Kiyomi Morino, Robert S. Webb, Kevin Werner, Dennis P. Lettenmaier. Understanding Uncertainties in Future Colorado River Streamflow. *Bulletin of the American Meteorological Society*, 2013; 130625085810007 DOI: [10.1175/BAMS-D-12-00228.1](https://doi.org/10.1175/BAMS-D-12-00228.1)

Ward, P.J., Eisner, S., Florke, M., Dettinger, M., and Kummu, M., 2014, Annual flood sensitivities to El Nino/Southern Oscillation at the global scale: *Hydrology and Earth System Science*, 18, 47-66, doi:10.5194/hess-18-47-2014.

White, A.B., Anderson, M.L., Dettinger, M.D., Ralph, F.M., Hinajosa, A., Cayan, D.R., Hartman, R.K., Reynolds D.W., Johnson, L.E., Schneider, T.L., Cifelli, R., Toth, Z., Gutman, S.I., King, C.W., Gerhke, F., Johnston, P.E., Walls, C., Gottas, D.J., and Coleman, T., 2013, A 21st Century California observing network for monitoring extreme

weather events: *Journal of Atmospheric and Oceanic Technology*, 30, 1585-1603, doi:10.1175/JTECH-D-12-00217.1.

Other Journal Articles:

Dettinger, M., 2014, Climate change—Impacts in the third dimension: *Nature Geoscience News and Views*, 7, 166-167, doi:10.1038/ngeo2096.

Dettinger, M., and Cox, D., 2014, Planning for the Atmospheric River threat: USACE Silver Jackets Quarterly Newsletter (The Buzz), 8-9.

Books/Articles-in-Books:

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